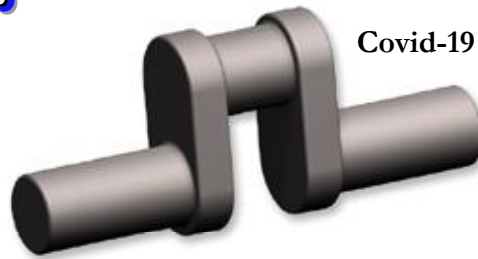


The Crank Calls

Covid-19 Spring 2020



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MEMBERSHIP \$25.00 US

Contact Paul Denham at
pedenham@comcast.net

NEXT MEETING

To be Announced
Considering July 16, 2020

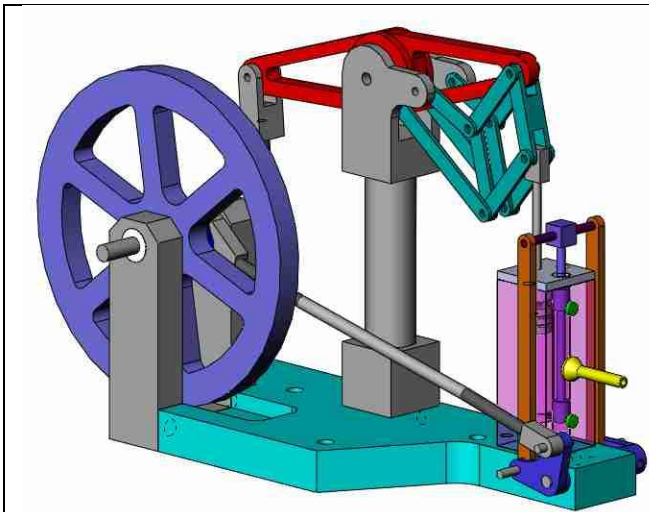
Doors open at 9:00 AM
Meeting starts at 10:00 AM

Upcoming Events

- Shelter in place . . . and make chips.

In compliance with "shelter at home" guidance the April, May and June 2020 BAEM meetings have been cancelled. Some members have been productive in the shop and this special edition of the newsletter addresses one such instance. Paul Denham has, with Dwight's support, been striving to approach Dwight's model engine productivity. Paul's current output rate is impressive so with another two score years of building he could be closing in on Dwight.

The current topic is Paul's design of a beam steam engine with some interesting features.



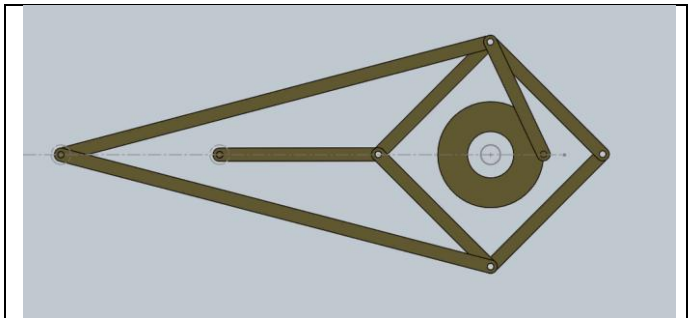
Frank's HMEM inspirational posting became

Paul's Covid Lock Down Beam Engine

To fully appreciate the design, a short tech topic might be of interest. Double acting steam engines provide power on piston strokes in both directions. This requires a pressure seal around the connecting rod exiting the bottom cylinder cover between the piston and the crank. Most steam engine designs have some means of constraining the rod to be aligned with the center of the cylinder in order to better achieve a high pressure seal. Vertical engines use a cross head bearing and horizontal engines use bearing blocks. Both designs use 2 part connecting rods so that linear motion of the cylinder is converted to rotational motion of the crank while keeping rod motion through the gland strictly linear. Beam engines use similar rod assemblies between the beam and the piston.

Mike Byrne's introduction to Paul's project came in an email asking if I could whip out a Solidworks motion simulation of a Peaucellier–Lipkin linkage. Answering the question took some research and Wikipedia helped (https://en.wikipedia.org/wiki/Peaucellier%E2%80%93Lipkin_linkage). The "why" became more apparent when he forwarded a link to a Brian Rupnow HMEM thread that included snips of poster Frank's beam engine assembly drawings. In short, Peaucellier-Lipkin linkage converts rotational motion to linear motion. Note that this allows a single piece connecting rod between the linkage and the piston.

Paul had the engine 3/4 cut before I refreshed my Solidworks skills enough to get the simulation running. His design significantly evolved from Frank's posting. Paul also found the Link 3 linkage program (www.rectorsquid.com) mentioned by Mike Rehmus and may have used it for some motion simulations. I've come to suspect Paul does assembly his sketches in g-code.



Mike's quick (?) Peaucellier–Lipkin Solidworks Motion Simulation

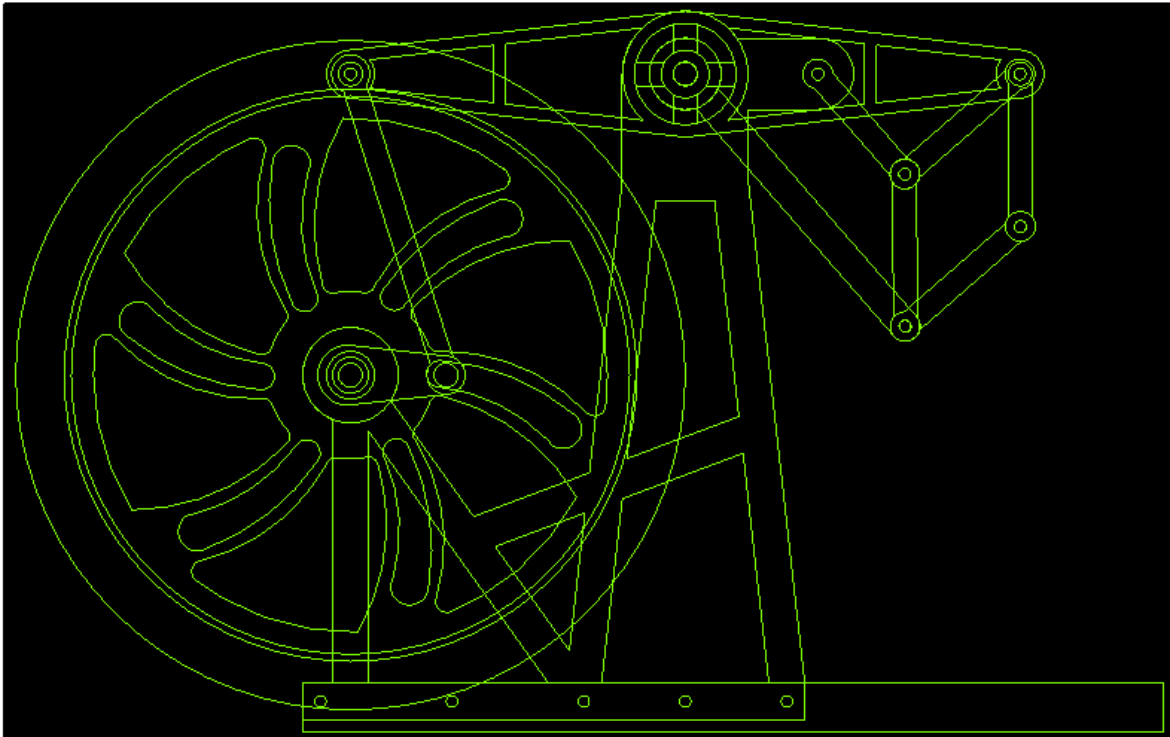
http://www.baemclub.com/pages/engineering_refs/Ass_em2_works.avi

From Paul's Home Model Engine Machinist (HMEM) forum posting (after he got it running) (<https://www.homemodelenginemachinist.com/threads/beam-engine-with-peaucelliar-lipkin-linkage.32144>):

"Well here goes the long story. I built a Stuart BEAM engine in ~1989. I learned about the "Watt's" parallel motion. Studying this I found out about the Peaucelliar -Lipkin linkage that is "perfect" . I have always had it in the back of my mind. So with time on my hands I did a search and found that was a link to Brian Rupnow's beam engine that a modeler suggested. Modifying his to this linkage. Well Don't know if he ever built one , but I have. I split the beam, flywheel in the center. Frame instead of post. The Steam details are all clones without castings of the Stuart design. It is ball bearing crank, eccentric, and beam. Delrin piston and packing glands. Made for air only. Super smooth. My pressure regulator gauge doesn't even register when it is running. I am antiquated and use CAMBAM to make my Gcode so I have no fancy drawings. But dxf if anyone is interested."

The scale dynamo in a matching case was added to complete the project.

Work in progress

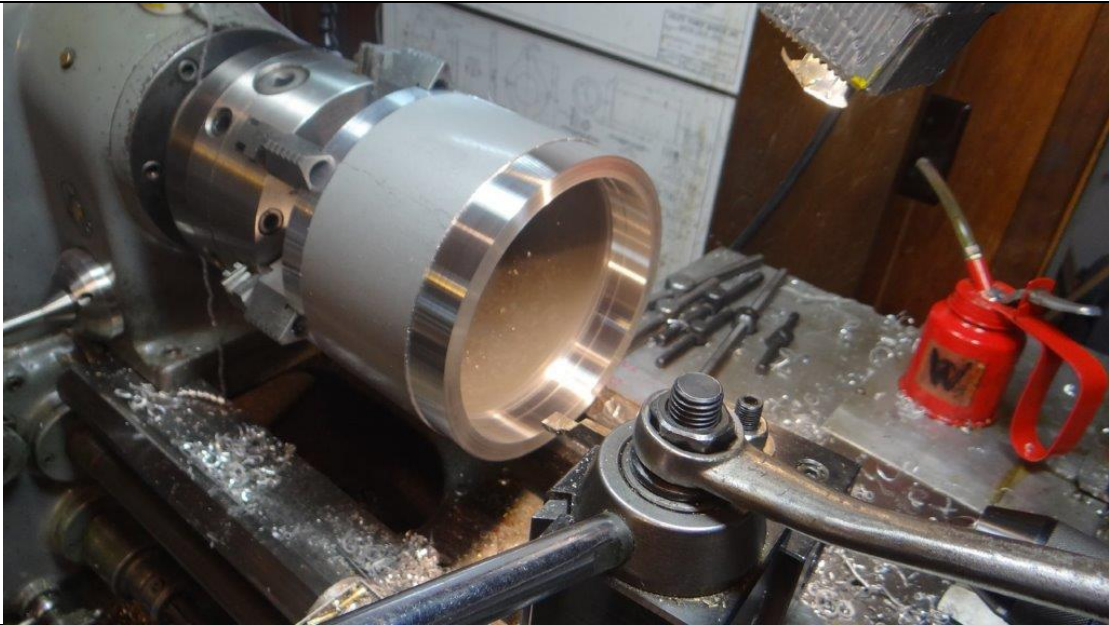


Partial assembly dxf file (copy & paste to browser)

http://www.baemclub.com/pages/engineering_refs/Paul_Beam.dxf



Awaiting x-axis controller board replacement



Flywheel rim from Dwight's SCUBA tank



Flywheel spoke and hub machining underway after new X-controller installed



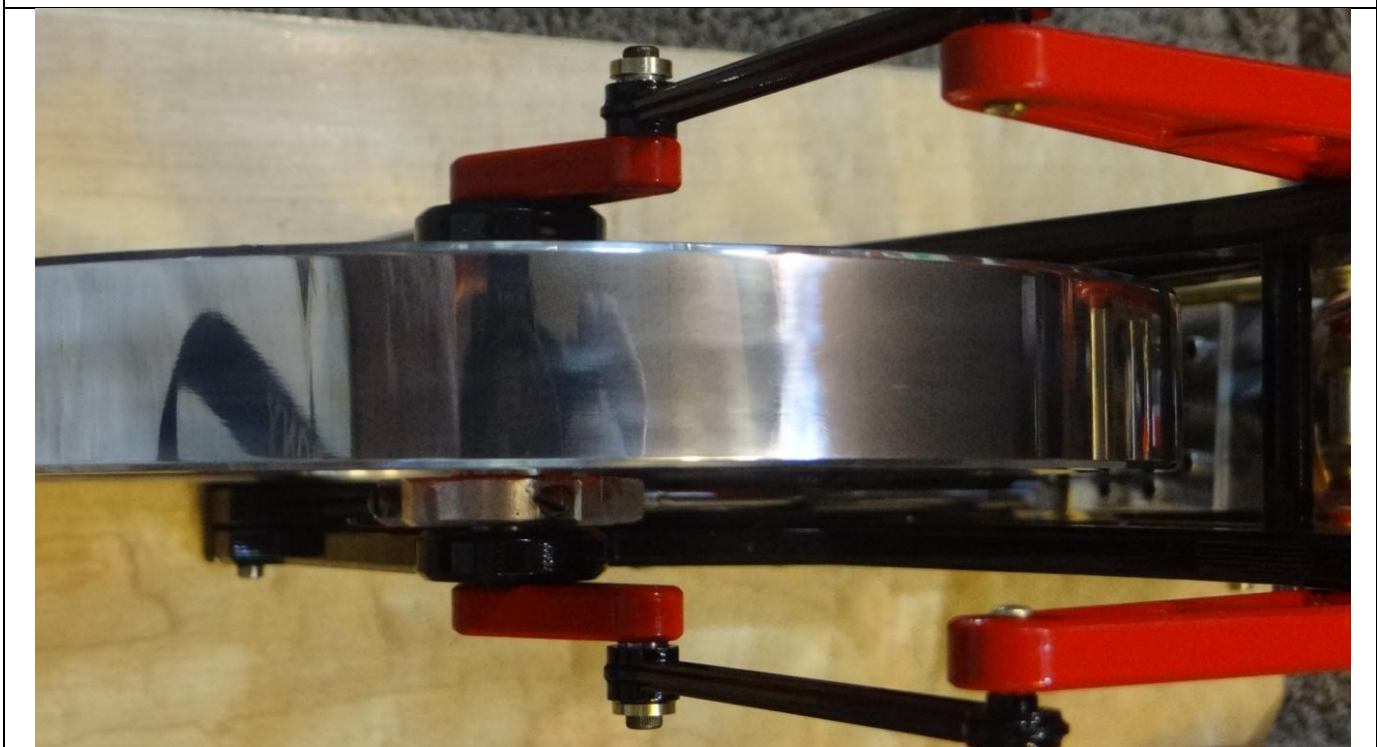
All those linkages mated without a bit of fiddling (right Paul?)



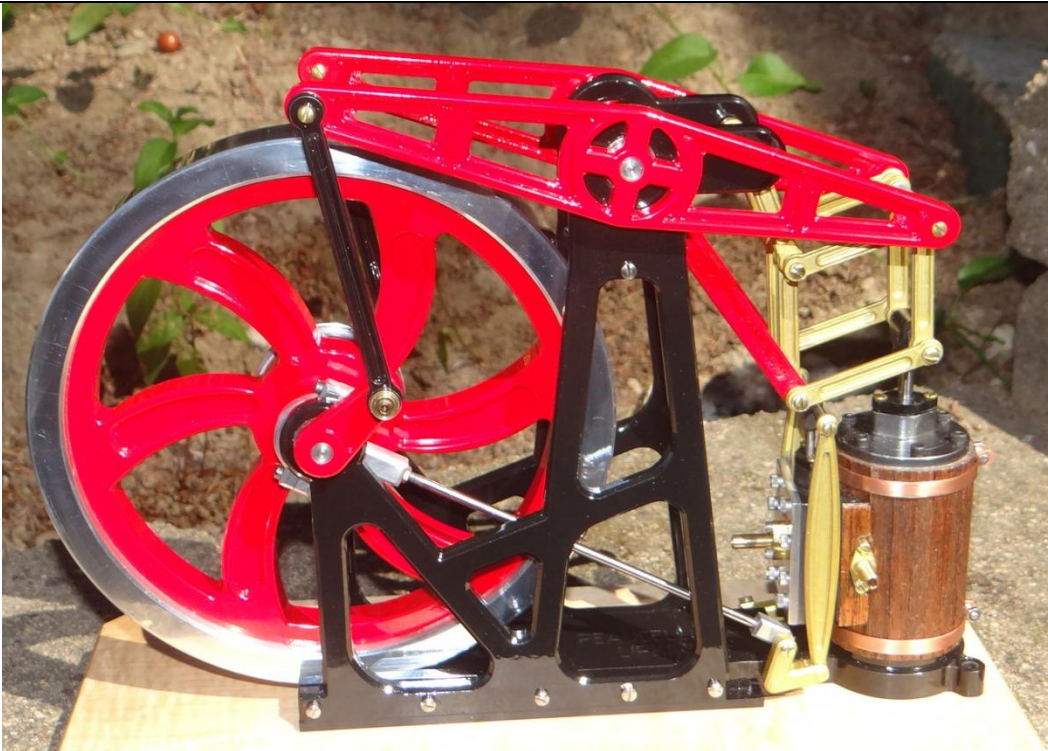
First motion fit check (http://www.baemclub.com/pages/engineering_refs/first-motion.mp4)



Documenting the linkage design

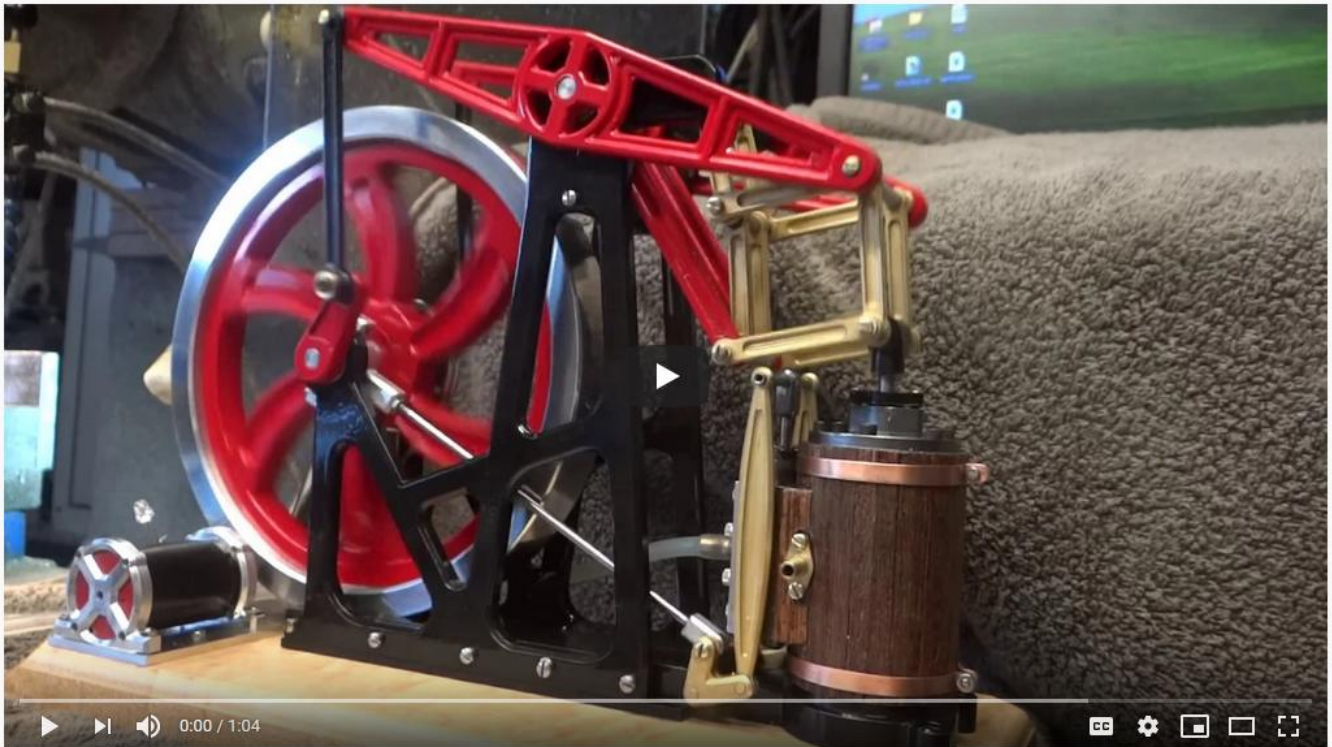


Flywheel polished per Bob Krdajin tutelage



Pretty impressive

Paul's dual bean steam engine with dynamo on You Tube



You Tube link: <https://www.youtube.com/watch?v=FO-01KzhIyo&feature=youtu.be> converting electrical power to entropy via compressed air -> rotary motion -> DC current -> LED illumination.